COURSE AND OPTIONS SELCTION HANDBOOK

INDUSTRIAL

ENGINEERING

3RD YEAR

Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

CONTENTS

WHAT IS COURSE AND OPTIONS SELECTION (COS)?

Each year the Office of the Registrar asks you to provide them with indicators as to which program option and technical elective courses you plan to take in the coming academic year. The information that you provide to us through Course and Options Selection (COS) helps us identify the demand for program options and courses. This information is used for the course scheduling process and for uploading your course selections to ACORN. When selecting your technical electives, be sure that your selections meet the program requirements for your program of study. Please be advised that students who do not participate in COS will not be guaranteed a space in technical elective courses, so it is in your best interest to submit your selections.

We greatly appreciate your cooperation with this exercise.

It can be completed on Degree Explorer

ALL INFORMATION IN THIS HANDBOOK WAS MOST RECENTLY UPDATED IN JUNE 2022. COURSES, DEGREE REQUIREMENTS, AND DATES MAY CHANGE FROM YEAR TO YEAR. PLEASE REFER TO THE CURRENT YEAR'S ENGINEERING ACADEMIC CALENDAR.

IMPORTANT DATES

DATE	
EARLY FEBRUARY	**3RD YEAR INDY CURRICULUM TALK**
MID FEBRUARY – EARLY MARCH	**COURSE & OPTIONS SELECTION OPENS** Degreeexplorer.utoronto.ca Students may now login and make their curriculum selections for the upcoming academic year
MID JULY	**COURSE SELECTION (ROUND 1) OPENS *ACORN*** Students may now make changes to their timetable. Electives offered by the Faculty of Engineering and Enhanced Enrollment Arts & Science electives are now open for enrollment
MID AUGUST	**COURSE SELECTION (ROUND 2) OPENS *ACORN*** For courses offered by the Faculty of Arts & Science
LATE AUGUST	**LAST DAY TO PAY OR DEFER TUITION FEES**
EARLY SEPTEMBER	**ENGINEERING FALL (F) LECTURES BEGIN**
LATE SEPTEMBER	**FALL (F) & FULL-YEAR (Y) COURSE ADD DEADLINE** Last day to add or substitute Fall (F) or Full-Year (Y) Session courses
EARLY NOVEMBER	**FALL (F) COURSE DROP DEADLINE** Last day to drop Fall (F) Session courses without academic penalty, withdraw from the Fall (F) session without academic penalty, or transfer to part-time studies for the Fall (F) session
EARLY JANUARY	**ENGINEERING WINTER (S) LECTURES BEGIN**
MID JANUARY	**WINTER (S) COURSE ADD DEADLINE** Last day to add or substitute Fall (S)
EARLY MARCH	**WINTER (S) & FULL YEAR (Y) COURSE DROP DEADLINE**

For a complete list of the Sessional Dates click here
For Fee and Refund Schedule information click here

CURRICULUM

FALL SESSION – YEAR 3

REQUIRED CORE COURSES	
MIE343H1	Industrial Ergonomics and the Workplace
MIE350H1	Design and Analysis of Information Systems
MIE360H1	Systems Modelling and Simulation
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE344H1	Ergonomic Design of Information Systems
MIE354H1	Business Process Engineering
MIE365H1	Operations Research III: Advanced OR
MIE368H1	Analytics in Action
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE*	

For further information, visit the Engineering Academic Calendar

WHAT IS A CS ELECTIVE? Complementary Studies (CS) can be broadly defined as studies in humanities, social sciences, arts, management, engineering economics and communication that complements technical curriculum. Engineering, math or science courses—including astronomy and psychology—may not be used to fulfill your CS elective requirement. Additionally, the Rotman School of Management does not typically permit students outside of their faculty to take their courses (i.e. RSM courses).

WHAT IS AN HSS ELECTIVE? Humanities and Social Sciences (HSS) courses explore the central issues, thought processes and scholarly methods found in these disciplines. Please note HSS electives are a subset of Complementary Studies (CS) courses; they can be used to satisfy CS elective requirements.

**Students must complete 4 CS/HSS electives, including 2 mandatory HSS electives. Every HSS is considered a CS, but not every CS is considered an HSS.*

WINTER SESSION – YEAR 3

REQUIRED CORE COURSES	
MIE335H1	Algorithms and Numerical Methods
MIE363H1	Operations and Supply Chain Management
MIE364H1	Quality Control and Improvement
TECHNICAL ELECTIVE (CHOOSE ONE):	
APS360H1	Applied Fundamentals of Deep Learning
MIE345H1	Case Studies in Human Factors and Ergonomics
MIE367H1	Cases in Operations Research
MIE369H1	Introduction to Artificial Intelligence
MIE469H1	Reliability and Maintainability Engineering
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE*	

For further information visit the Engineering Academic Calendar

CAN I APPLY FOR A TECHNICAL ELECTIVE SUBSTITION? No. You must choose a technical elective off the approved curriculum list. Only in fourth year are IndE students able to apply for a technical elective substitution.

**Students must complete 4 CS/HSS electives, including 2 mandatory HSS electives. Every HSS is considered a CS, but not every CS is considered an HSS.*

AREAS OF FOCUS

HUMAN FACTORS

Industrial Engineers also improve productivity and efficiency by studying and improving the actual physical work environment. Human factors engineering is the study of people as workers and as managers, both from the physiological and psychological points of view. The study of human physiology, particularly the nervous system, leads to fascinating discoveries concerning reaction to stimuli, sensory perception, human performance at operator tasks, and people's ability to process information. These principles are applied to the design of human-machine systems, with particular attention to problems of information display, control layout, compensatory controls systems, and the design of work environments. People's behaviour in work organisations is examined from the point of view of individual and social psychology. These studies lead to important conclusions concerning managerial and leadership styles, organisational goals and incentives, employee relations, and the implementation of planned change.

For example, a mechanical engineer may design a new car, and a human factors engineer would be responsible for the design of the interior: control layout, seating, vision, reachability, usability in unusual circumstances, etc. A nuclear engineer will design a nuclear generator, and a human factors engineer will design the control system displays to minimise the probability of human error.

CORE COURSES

3F - MIE343H1F - INDUSTRIAL ERGONOMICS AND THE WORKPLACE

The Biology of Work: anatomical and physiological factors underlying the design of equipment and work places. Biomechanical factors governing physical workload and motor performance. Circadian rhythms and shift work. Measurement and specification of heat, light, and sound with respect to design of the work environment.

SUGGESTED TECHNICAL ELECTIVES (3RD YEAR)

3F – MIE344H1F – ERGONOMIC DESIGN OF INFORMATION SYSTEMS

The goal of this course is to provide an understanding of how humans and machines can be integrated with information systems. By the end of the course, students will be able to: Observe, and engage in dialogue with, users in ways that clarify users' views, needs, and capabilities; Develop all phases of the user interface design process in response to the needs of a user interface design project; Demonstrate initiative, personal responsibility and accountability in both personal and group contexts; Communicate information, analyses, and solutions accurately, reliably, orally, and in writing to a range of audiences (e.g., the professor, the TAs, classmates, users); Extend the insights they have gained from their experience through the course in their future interactions with users in the workplace; Use the completed project to promote their candidacy for employment opportunities.

3W – MIE345H1S – CASE STUDIES IN HUMAN FACTORS AND ERGONOMICS

A detailed analysis will be made of several cases in which human factors methods have been applied to improve the efficiency with which human machine systems operate. Examples will be chosen both from the area of basic ergonomics and from high technology. Emphasis will be placed on the practical use of material learned in earlier human factors courses and ergonomics methods to a set of circumstances under which humans are considered central to the proposed solution; Understand and mitigate obstacles associated with conducting human factors and ergonomics activities in different situations; Map human factors and ergonomics characteristics of different case studies to the Human-Tech ladder; Demonstrate initiative, personal responsibility, and accountability in both personal and group contexts; Use "real-world" knowledge acquired from this course to market candidacy for employment opportunities

SUGGESTED TECHNICAL ELECTIVES (4TH YEAR ONLY)

MIE440H1	Design of Innovative Products
MIE523H1	Engineering Psychology and Human Performance
MIE457H1	Knowledge Modelling and Management
MIE542H1	Human Factors Integration
MIE561H1	Healthcare Systems
MIE567H1	Dynamic and Distributed Decision Making

FIELDS OF APPLICATION

Transportation, Communication, Healthcare, Military, Energy, Banking

SAMPLE COURSE SELECTION AREA (3RD YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE343H1	Industrial Ergonomics and the Workplace
MIE350H1	Design and Analysis of Information Systems
MIE360H1	Systems Modelling and Simulation
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE344H1	Ergonomic Design of Information Systems
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE335H1	Algorithms and Numerical Methods
MIE363H1	Resource and Production Modelling
MIE364H1	Quality Control and Improvement
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE345H1	Case Studies in Human Factors and Ergonomics
COMPLEMENTARY SUDIES OR HUMANITIES AND	

SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

SAMPLE COURSE SELECTION FOR AREA (4TH YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE463H1	Integrated Systems Design
MIE490Y1	Capstone Design
TECHNICAL ELECTIVES (TWO OF):	
APS502H1	Financial Engineering
MIE365H1	Operations Research III: Advanced OR
COMPLEMENTARY SUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE459H1	Organization Design
MIE490Y1	Capstone Design
TECHNICAL ELECTIVES (TWO OF):	
MIE542H1	Human Factors Integration
MIE561H1	Healthcare Systems
COMPLEMENTARY SUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

OPERATIONS RESEARCH

Operations research and management science involve the mathematical modelling of real systems and processes with a view to being able to predict and optimally control their performance. For example, we can use statistics to determine how much inventory should be carried in a warehouse to minimise expected costs of carrying the stock and of shortages. We use queueing theory to analyse the waiting time of people or jobs waiting for service in banks, emergency rooms and production facilities. We use linear algebra (called linear programming) to determine the optimal product mix to maximise profit subject to capacity constraints on resources, or the optimal allocation of service facilities (like fire stations) to minimize the expected service time. Areas include scheduling, reliability, maintenance, forecasting, queueing, value analysis and decision making under uncertainty.

Operations Research came into its own during the Second World War, when it became apparent that many problems of scheduling and deployment of resources, which had previously been managed intuitively, could be quantitatively modelled and solved analytically. Since the war, operations research techniques and models have been applied in an ever-increasing variety of industries, from finance to healthcare to government. The modern manager can no longer rely on seat-of-the-pants judgement, but must take a scientific approach to decision making. Much of today's industrial engineering activity is the application of management science in support of decision making at all levels of any organisation. Design, develop and use simulation models for improved decision making.

CORE COURSES

3F - MIE360H1F – SYSTEMS MODELLING AND SIMULATION

Principles for developing, testing and using discrete event simulation models for system performance improvement. Simulation languages, generating random

variables, verifying and validating simulation models. Statistical methods for analyzing simulation model outputs, and comparing alternative system designs. Fitting input distributions, including goodness of fit tests. Role of optimization in simulation studies.

3W - MIE335H1S – ALGORITHMS & NUMERICAL METHODS

Algorithmic analysis, big-O asymptotic analysis; numerical linear algebra, solution techniques for linear and non-linear systems of equations; matrix factorization, LU and Cholesky factorization, factorization in the revised simplex method; Newton's method, Gale-Shapley method, greedy methods for combinatorial optimization, branch-and-bound search methods; graph theory and graph theoretic algorithms; design and implementation of algorithms to optimize mathematical models.

SUGGESTED TECHNICAL ELECTIVES (3RD Year)

3F – MIE354H1F – BUSINESS PROCESS ENGINEERING

This course focuses on understanding multiple perspectives for grouping, assessing, designing and implementing appropriately integrated and distributed information systems to support enterprise objectives. The emphasis is on understanding how Business Process Management techniques and tools can contribute to align an organization's business and information technology perspectives, as well as the characteristics of application and system types and the implications for their design, operation, and support of information needs. The course reviews platforms and technology infrastructure, including; legacy systems, client/server, the Internet, the World Wide Web, and the emergence of a web-service based service oriented architecture. Students will work in the laboratory to develop a business process.

The course covers Information Systems concepts, tools and techniques, and it is addressed primarily to an audience of process/business analysts instead of targeting an audience of developers/programmers.

3F – MIE365H1F – OPERATIONS RESEARCH III: ADVANCED OR Design of operations research models to solve a variety of open-ended problems. Linear programming extensions are presented: goal programming, column generation, Dantzig-Wolfe decomposition, and interior point solution methods. Non-linear programming solution methods are developed: optimality conditions, quadratic programming and bi-level programming. Solutions to advanced stochastic models: stochastic programming, 2-person and n-person game theory, and Markov Decision Processes.

3F – MIE368H1F - ANALYTICS IN ACTION

This course showcases the impact of analytics focusing on real world examples and case studies. Particular focus on decision analytics, where data and models are combined to ultimately improve decision-making. Methods include: linear and logistic regression, classification and regression trees, clustering, linear and integer optimization. Application areas include: healthcare, business, sports, manufacturing, finance, transportation, public sector.

3W – MIE367H1S – CASES IN OPERATIONS RESEARCH

To provide students with the experience and confidence to apply Operational Research techniques to solve a variety of cases that industrial engineers may face in their professional life. The course will use one case per week which describes a real situation. Students will be required to analyze the case on their own, in a small group and with the class. Extensive preparation of each case prior to class participation is essential for the success of this course. After initial discussion, students will be required to fully solve the case, including a numerical solution. Timely individual analysis and solution of each case is critical to both class participation and development of the ability to analyze a case during the midterm and final exams.

3W – MIE469H1S – RELIABILITY & MAINTAINABILITY ENGINEERING

An introduction to the life-cycle costing concept for equipment acquisition, operation, and replacement decision-making. Designing for reliability and determination of optimal maintenance and replacement policies for both capital equipment and components. Topics include: identification of an item's failure distribution and reliability function, reliability of series, parallel, and redundant systems design configurations, time-to-repair and maintainability function, age and block replacement policies for components, the economic life for capital equipment, provisioning of spare parts.

SUGGESTED TECHNICAL ELECTIVES (4th YEAR Only)

APS502H1	Financial Engineering
MIE451H1	Decision Support Systems
MIE566H1	Decision Analysis
MIE562H1	Scheduling
MIE519H1	Advanced Manufacturing Technologies
MIE561H1	Healthcare Systems

FIELDS OF APPLICATION

Logistics, Supply Chain Management, Healthcare, Production System, Financial Engineering, Maintenance

SAMPLE COURSE SELECTION FOR AREA (3RD YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE343H1	Industrial Ergonomics and the Workplace
MIE350H1	Design and Analysis of Information Systems
MIE360H1	Systems Modelling and Simulation
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE354H1	Business Process Engineering
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE335H1	Algorithms and Numerical Methods
MIE363H1	Resource and Production Modelling
MIE364H1	Quality Control and Improvement
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE345H1	Cases in Operations Research
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

SAMPLE COURSE SELECTION FOR AREA (4th YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE463H1	Integrated System Design
MIE490Y1	Capstone

TECHNICAL ELECTIVES (TWO OF):	
APS502H1	Financial Engineering
MIE365H1	Operations Research III: Advanced OR
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE459H1	Organization Design
MIE490Y1	Capstone
TECHNICAL ELECTIVES (TWO OF):	
MIE542H1	Human Factors Integration
MIE567H1	Dynamic and Distributed Decision Making
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Artificial intelligence (AI) is the study of computational processes that simulate intelligent behaviour. These processes include knowledge representation and reasoning, optimal sequential decision-making under uncertainty, and learning from past experience. Specifically, the last area comprises the subfield of AI known as Machine learning (ML) that focuses on computational and statistical methods for learning patterns from historical data for descriptive and predictive purposes.

Together, AI and ML represent the forefront of technology innovation powering a wide range of industrial applications including search engines, conversational assistants, e-commerce, autonomous driving, intelligent logistics scheduling, digital marketing, adaptive user interfaces, and health applications ranging from prediction of adverse outcomes to automated diagnosis in medical imaging. AI and ML both contribute to and benefit from techniques developed in Operations Research (OR) although AI and ML techniques often tend to focus more heavily on the computational and algorithmic aspects of proposed solutions.

To this end, strong preparation in programming and software design is an essential skill for AI and ML practitioners. AI and ML expertise is in high demand in industry with employment in all of the aforementioned application areas and many more; it is also an excellent course of study for those wishing to pursue future research careers in this field with rapidly expanding frontiers.

CORE COURSES

3W - MIE335H1S - ALGORITHMS & NUMERICAL METHODS

Algorithmic analysis, big-O asymptotic analysis; numerical linear algebra, solution techniques for linear and non-linear systems of equations; matrix factorization, LU and Cholesky factorization, factorization in the revised simplex method; Newton's

method, Gale-Shapley method, greedy methods for combinatorial optimization, branch-and-bound search methods; graph theory and graph theoretic algorithms; design and implementation of algorithms to optimize mathematical models.

TECHNICAL ELECTIVES

3F - MIE368H1F - ANALYTICS IN ACTION (FORMERLY MIE465)

This course showcases the impact of analytics focusing on real world examples and case studies. Particular focus on decision analytics, where data and models are combined to ultimately improve decision-making. Methods include: linear and logistic regression, classification and regression trees, clustering, linear and integer optimization. Application areas include: healthcare, business, sports, manufacturing, finance, transportation, public sector.

4F - MIE451H1F - DECISION SUPPORT SYSTEMS

This course provides students with an understanding of the role of a decision support system in an organization, its components, and the theories and techniques used to construct them. The course will cover basic technologies for information analysis, knowledge-based problem solving methods such as heuristic search, automated deduction, constraint satisfaction, and natural language understanding.

4F - MIE566H1F - DECISION ANALYSIS

The purpose of this course is to provide a working knowledge of methods of analysis of problem and of decision making in the face of uncertainty. Topics include decision trees, subjective probability assessment, multiattribute utility approaches, goal programming, Analytic Hierarchy Process and the psychology of decision-making.

4F - CSC384H1F – INRODUCTION TO ARTIFICIAL INTELLIGENCE

Theories and algorithms that capture (or approximate) some of the core elements of computational intelligence. Topics include: search; logical representations and reasoning, classical automated planning, representing and reasoning with uncertainty, learning, decision making (planning) under uncertainty. Assignments provide practical experience, in both theory and programming, of the core topics.

4S - MIE424H1S - OPTIMIZATION IN MACHINE LEARNING

1. To enable deeper understanding and more flexible use of standard machine learning methods, through development of machine learning from an Optimization perspective. 2. To enable students to apply these machine learning methods to

problems in finance and marketing, such as stock return forecasting, credit risk scoring, portfolio management, fraud detection and customer segmentation.

4S – MIE369H1 – INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Introduction to Artificial Intelligence. Search. Constraint Satisfaction. Propositional and First-order Logic Knowledge Representation. Representing Uncertainty (Bayesian networks). Rationality and (Sequential) Decision Making under Uncertainty. Reinforcement Learning. Weak and Strong AI, AI as Engineering, Ethics and Safety in AI.

4S - MIE457H1S - KNOWLEDGE MODELING AND MANAGEMENT
This course explores both the modeling of knowledge and its management within and among organizations. Knowledge modeling will focus on knowledge types and their semantic representation. It will review emerging representations for knowledge on the World Wide Web (e.g., schemas, RDF). Knowledge management will explore the acquisition, indexing, distribution and evolution of knowledge within and among organizations. Emerging Knowledge Management System software will be used in the laboratory.

4S – APS360H1S – APPLIED FUNDAMENTALS OF DEEP LEARNING
A basic introduction to the history, technology, programming and applications of the fast evolving field of deep learning. Topics to be covered may include neural networks, autoencoders/decoders, recurrent neural networks, natural language processing, and generative adversarial networks. Special attention will be paid to fairness and ethics issues surrounding machine learning. An applied approach will be taken, where students get hands-on exposure to the covered techniques through the use of state-of-the-art machine learning software frameworks.

4S – ROB311H1 – ARTIFICIAL INTELLIGENCE
An introduction to the fundamental principles of artificial intelligence from a mathematical perspective. The course will trace the historical development of AI and describe key results in the field. Topics include the philosophy of AI, search methods in problem solving, knowledge representation and reasoning, logic, planning, and learning paradigms. A portion of the course will focus on ethical AI, embodied AI, and on the quest for artificial general intelligence.

SAMPLE COURSE SELECTION FOR AREA (3RD YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE343H1	Industrial Ergonomics and the Workplace
MIE350H1	Design and Analysis of Information Systems
MIE360H1	Systems Modelling and Simulation
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE368H1	Analytics in Action
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE335H1	Algorithms and Numerical Methods
MIE363H1	Resource and Production Modelling
MIE364H1	Quality Control and Improvement
TECHNICAL ELECTIVE (CHOOSE ONE):	
APS360H1	Applied Fundamentals of Deep Learning
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

SAMPLE COURSE SELECTION FOR AREA (4th YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE463H1	Integrated System Design
MIE490Y1	Capstone
TECHNICAL ELECTIVES (TWO OF):	
CSC384H1	Introduction to Artificial Intelligence
MIE368H1	Analytics in Action
MIE451H1	Decision Support Systems
MIE566H1	Decision Analysis
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE459H1	Organization Design
MIE490Y1	Capstone
TECHNICAL ELECTIVES (TWO OF):	
MIE369H1	Introduction to Artificial Intelligence
MIE424H1	Optimization in Machine Learning
MIE457H1	Knowledge Modeling & Management
ROB311H1	Artificial Intelligence
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

INFORMATION ENGINEERING

The Information Engineering specialization of the Industrial (Systems) Engineering program creates professionals that address the challenge of successfully applying information technology to help people and organizations innovate and become more efficient.

Our graduates have outstanding employment opportunities in numerous private and public organizations as well as in the global consulting firms that service them. There is current and future demand for professionals that combine expertise in process design and management, business analysis, project management, systems integration, and a fusion of industry knowledge and information technology skills.

Information engineering provides exciting and diverse career opportunities that encompass the development and evolution of information systems. Our graduates address the following challenging issues: how to provide doctors and nurses with timely access to electronic patient data wherever is needed, how to design information systems that run the business of online stores such as music download sites and bookstores, how to reduce large volumes of data into information that is useful to the decision-making processes of government officials, and how to take advantage of information technology to plan, coordinate and support disaster recovery and relief efforts

CORE COURSES

3F - MIE350H1F – DESIGN & ANALYSIS OF INFORMATION SYSTEMS

Provides students with an understanding of the methods of information system analysis and design. These include methods for determining and documenting an

organization's structure (FDD), activities, behaviours and information flows (DFDs, decision tables and trees, network diagrams, etc); model acquisition (data repositories), verification and validation. Methods such as SADT, RAD and prototyping will be covered. Students will acquire a working knowledge of various frameworks for analysis (e.g., information technology categories, system and application classifications, decision types, data vs information). Throughout the course, emphasis is placed on the importance of systems thinking and organizational culture in the analysis and design process. In the laboratory, students will use a CASE-based computer program (Visible Analyst) for the analysis and design of information systems for selected organizations. Students will be asked to work in teams to create a web-based information site and to document and present their development progress through the use of a structured project log.

3F - MIE360H1F – SYSTEMS MODELLING AND SIMULATION

Principles for developing, testing and using discrete event simulation models for system performance improvement. Simulation languages, generating random variables, verifying and validating simulation models. Statistical methods for analyzing simulation model outputs, and comparing alternative system designs. Fitting input distributions, including goodness of fit tests. Role of optimization in simulation studies.

3W - MIE335H1S – ALGORITHMS & NUMERICAL METHODS

Algorithmic analysis, big-O asymptotic analysis; numerical linear algebra, solution techniques for linear and non-linear systems of equations; matrix factorization, LU and Cholesky factorization, factorization in the revised simplex method; Newton's method, Gale-Shapley method, greedy methods for combinatorial optimization, branch-and-bound search methods; graph theory and graph theoretic algorithms; design and implementation of algorithms to optimize mathematical models

SUGGESTED TECHNICAL ELECTIVES (3rd YEAR)

3F – MIE354H1 – BUSINESS PROCESS ENGINEERING

This course focuses on understanding multiple perspectives for grouping, assessing, designing and implementing appropriately integrated and distributed information systems to support enterprise objectives. The emphasis is on understanding how Business Process Management techniques and tools can contribute to align an organization's business and information technology perspectives, as well as the characteristics of application and system types and the implications for their design, operation and support of information needs, including those associated with

different platforms and technology infrastructure e.g., legacy systems, client/server, the Internet and World Wide Web including the emergence of a web-service-based service oriented architecture. Students will work in the laboratory to develop business processes that can be specified and executed by information systems supporting BPEL, a widely supported standard for describing web-service-based business process.

3F – MIE344H1 – ERGONOMIC DESIGN OF INFORMATION SYSTEMS

The goal of this course is to provide an understanding of how humans and machines can be integrated with information systems. The focus will be on the design of human-machine interfaces, and on the analysis of the impact of computers on people. The course will also include coverage of usability engineering and rapid prototyping design, analysis of user mental models and their compatibility with design models, and quantitative modelling of human-computer interaction.

3F – MIE368H1 - ANALYTICS IN ACTION (FORMERLY MIE465)

This course showcases the impact of analytics focusing on real world examples and case studies. Particular focus on decision analytics, where data and models are combined to ultimately improve decision-making. Methods include: linear and logistic regression, classification and regression trees, clustering, linear and integer optimization. Application areas include: healthcare, business, sports, manufacturing, finance, transportation, public sector.

SUGGESTED TECHNICAL ELECTIVES (4th YEAR ONLY)

APS502H1	Financial Engineering
MIE465H1	Analytics in Action
MIE451H1	Decision Support Systems
MIE566H1	Decision Analysis
MIE562H1	Scheduling
MIE519H1	Advanced Manufacturing Technologies
MIE561H1	Healthcare Systems

FIELDS OF APPLICATION

Data Analysis, Database Design, Business Process Modelling, Information Systems, Ontologies

SAMPLE COURSE SELECTION FOR AREA (3rd YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE343H1	Industrial Ergonomics and the Workplace
MIE350H1	Design and Analysis of Information Systems
MIE360H1	Systems Modelling and Simulation
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE354H1	Business Process Engineering
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE335H1	Algorithms and Numerical Methods
MIE363H1	Resource and Production Modelling
MIE364H1	Quality Control and Improvement
TECHNICAL ELECTIVE (CHOOSE ONE):	
MIE345H1	Case Studies in Human Factors and Ergonomics
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

SAMPLE COURSE SELECTION FOR AREA (4th YEAR)

FALL SESSION

REQUIRED CORE COURSES	
MIE463H1	Integrated System Design
MIE490Y1	Capstone
TECHNICAL ELECTIVES (TWO OF):	
APS502H1	Financial Engineering
MIE365H1	Operations Research III: Advanced OR
COMPLEMENTARY STUDIES OR HUMANITIES AND	

SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

WINTER SESSION

REQUIRED CORE COURSES	
MIE459H1	Organization Design
MIE490Y1	Capstone
TECHNICAL ELECTIVES (TWO OF):	
MIE542H1	Human Factors Integration
MIE567H1	Dynamic and Distributed Decision Making
COMPLEMENTARY STUDIES OR HUMANITIES AND SOCIAL SCIENCES ELECTIVE	
CS/HSS ELECTIVE	

DEGREE REQUIREMENTS

For official and up-to-date information on the Industrial Engineering Degree Requirements visit the Engineering Academic Calendar

DEGREE EXPLORER

Degree Explorer is a planning tool designed to help students and advisors evaluate academic progress towards completion of requirements for graduation. It is not a transcript. It allows you to map out your degree and can help you determine if you are on track. Just because you are able to enrol in a course on ACORN does not mean it will fulfill your degree requirements.

TO GRADUATE, YOU NEED

- All Core Courses
- 2.0 CS Credits (1.0 or more must be HSS)
- 3.0 Technical Elective Credits
- 600 hours of professional experience, or PEY credit

COMPLEMENTARY STUDIES (CS) AND HUMANITIES & SOCIAL SCIENCES (HSS)

To graduate, you must take 2.0 credits in complementary studies, of which at least 1.0 credits are HSS courses. 0.5 credits = 1 half year course. These are typically taken in second and fourth year, or in the summer (have to pay extra tuition). Students must complete 4 CS/HSS electives, including 2 mandatory HSS. For a list of faculty approved elective lists, please consult the following links. You can also request other A&S courses to act as a substitute:

For approved HSS electives click here

For approved CS electives click here

TECHNICAL ELECTIVES

- One in each semester 3rd year, two in each semester in 4th year
- Select from list of approved electives
- Can apply for another course to substitute for a Technical Elective
- Can substitute at most two technical electives

PRACTICAL EXPERIENCE REQUIREMENT (PER)

- Minimum of 600 hours to graduate
- Work should support professional career of student
- Must contain a good measure of responsibility
- Form must be filled out and submitted to MIE Undergrad Office
- If you do PEY, you do not need to submit PER form

To view a complete list of the MIE UG Forms click here

ENGINEERING MINORS & CERTIFICATES

CONTACT INFORMATION

In addition to academic programs in Core 8 subjects/TrackOne and Engineering Science, undergraduate Engineering students may pursue a number of minors and certificates that add breadth and depth to their academic careers. To obtain a minor, students must take six (6) courses in a particular field. A certificate requires three (3) courses. There are many minors and certificates and enrolling for a minor puts it on your Degree Explorer, which can help you plan. You can de-enrol at any point.

Minors and Certificates are managed by the Cross-Disciplinary Programs (CDP) Office and all inquiries associated with the minors should be addressed to **engineering.minors@utoronto.ca**. For further information on the types of minors available etc. click here

HOW DO I ENROL IN A MINOR?

Each minor has a specific enrolment form for you to complete and submit to the Cross-Disciplinary Programs Office. Please note that enrolling in a minor does not guarantee you a spot in any of the engineering minor electives, as they are open to everyone. To avoid disappointment, plan ahead and select courses 6 AM on course selection days. You are responsible for making sure you fulfill the requirements.

I DIDN'T GET INTO THE COURSES I WANTED TO, AND I'M WORRIED I WONT FINISH MY MINOR BEFORE GRADUATION. WHAT DO I DO?

Due to popularity, many engineering minor courses are offered in the summer. You are also welcome to complete those courses following graduation, it just may not appear on your degree until later. You can also visit the Cross-Disciplinary Programs Office to de-enrol you in a minor.

WILL MY HSS/CS ELECTIVES BE ADDED TO MY TIMETABLE AUTOMATICALLY? WHAT IF I AM ENROLLED IN A MINOR THAT REQUIRES THAT COURSE?

No, you must add them yourself on course selection days. Enrolling in a minor does not guarantee you a spot in its required courses.

I'M NOT SURE WHICH ELECTIVES TO TAKE.

The Arts & Science Student's Union puts together a publication called the Anti-Calendar, which provides honest student feedback about many Arts & Science elective courses offered. http://assu.ca/anti-calendar.

ENROLLMENT & REGISTRATION

OVERLOADS

• To take more than 5 courses in a semester, must receive approval from undergrad office
• Need to have a 2.7 CGPA

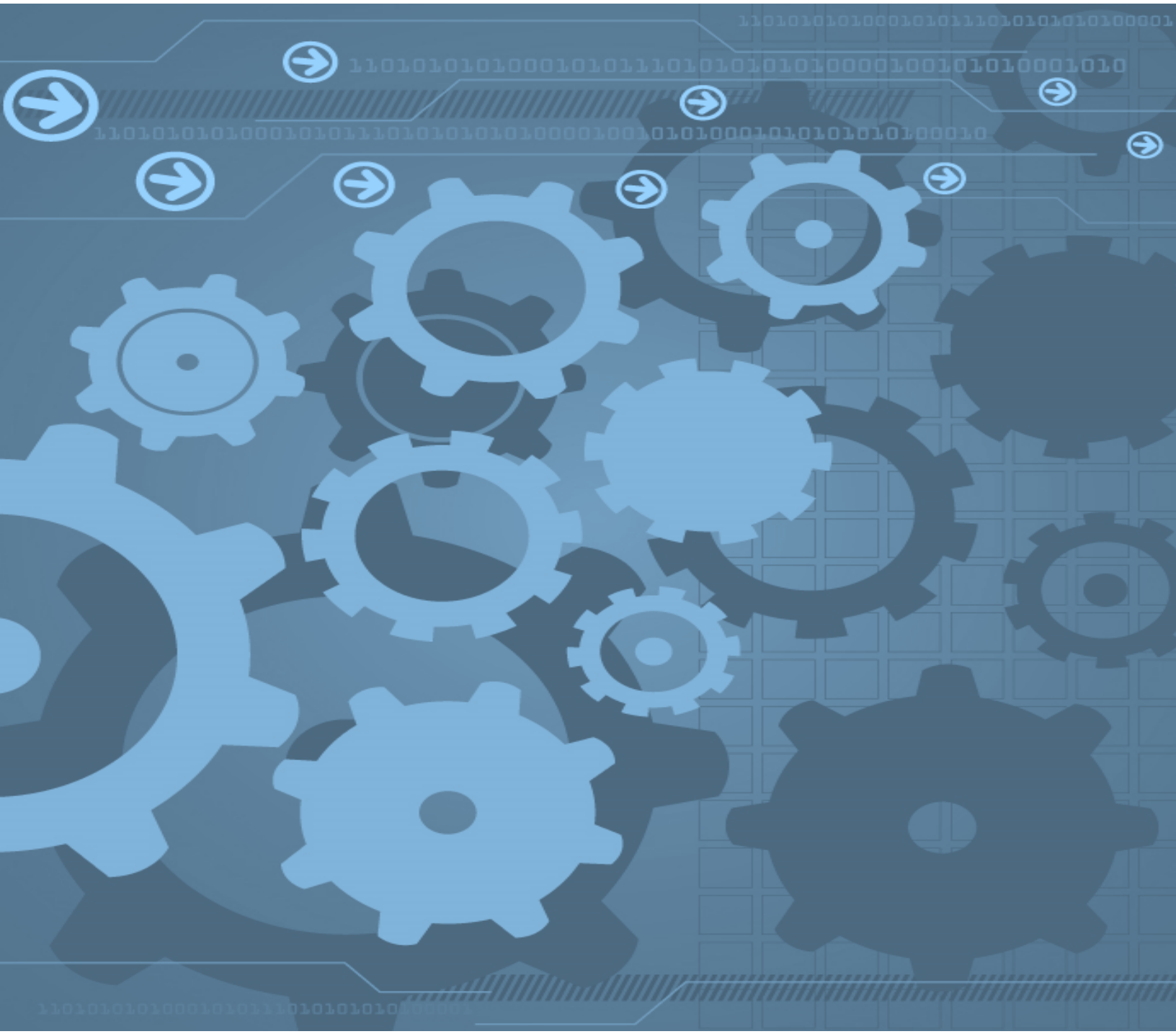
"EXT" OR EXTRA COURSES

• If taking a course not needed for your degree, you can apply to designate it as EXT.
• All courses that are above and beyond a students' degree requirements MUST be marked as Extra
• Mark will not count towards your GPA, but till shows up on transcript
• Credit can be used for minors/certificates
• Deadline to designate EXT is the same as drop deadline

FAILED COURSES

If you have failed a core curriculum course, you must re-take it at the next available opportunity. Many first year engineering courses are offered during the summer. If you were unsuccessful in a second or third year course that is a pre-requisite for an upper level course, you must retake the pre-requisite course first. To add a core curriculum course, submit the Course Request Form (https://www.mie.utoronto.ca/programs/ undergraduate/forms-policies/) to the Undergraduate Office by one week before the add course deadline. To add a failed stream course or CS/HSS elective, you may do so yourself on the course selection dates.

To view a complete list of the MIE UG Forms click here



MIE UG OFFICE CONTACT INFORMATION

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